

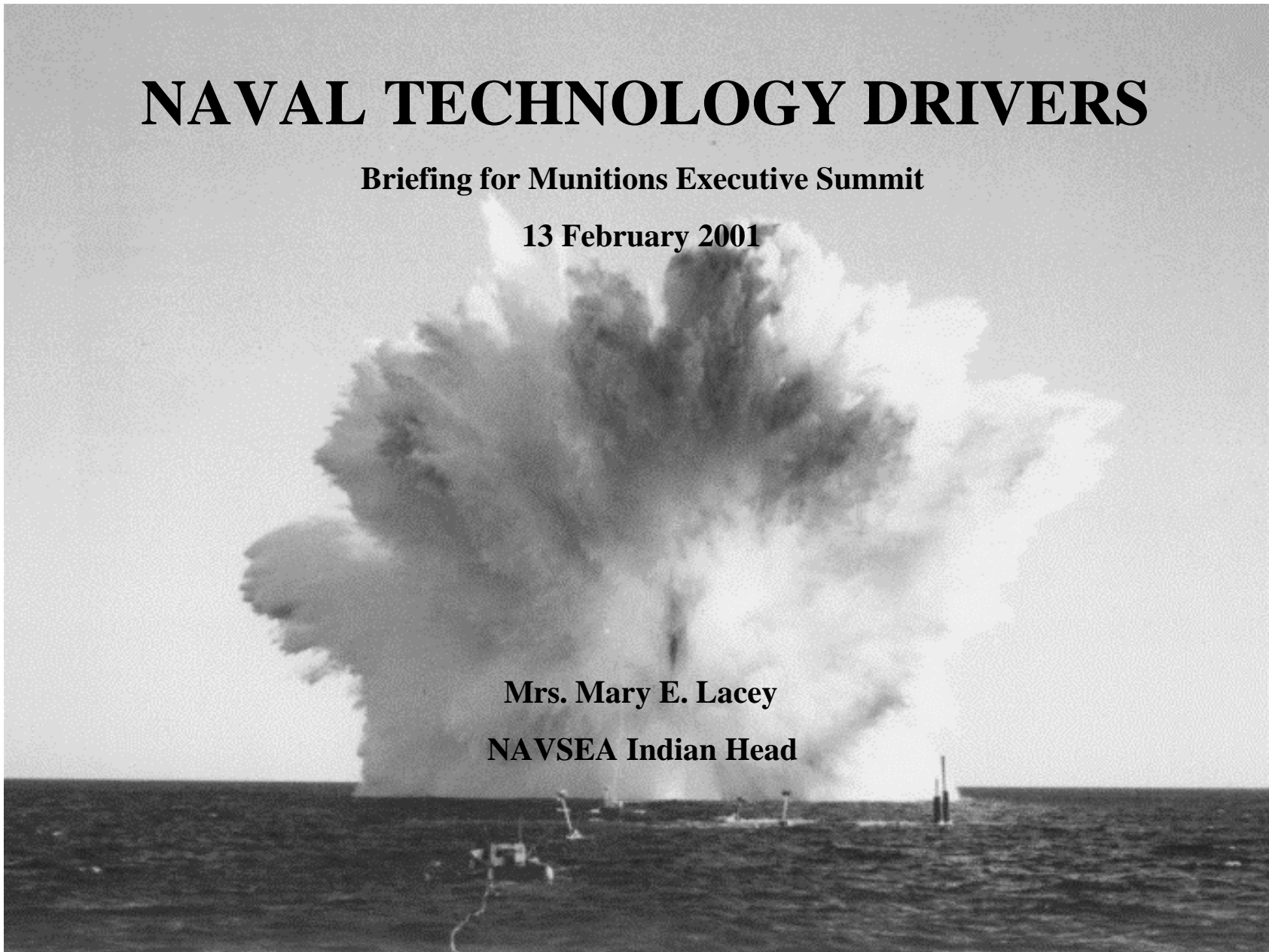
NAVAL TECHNOLOGY DRIVERS

Briefing for Munitions Executive Summit

13 February 2001

Mrs. Mary E. Lacey

NAVSEA Indian Head

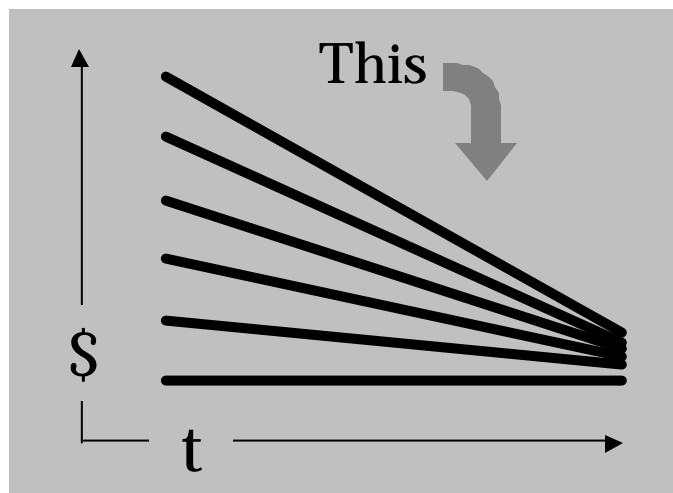




Outline

- Navy's S&T Program
- Impact Technologies
 - MEMS
 - Emerging Materials
 - Initiation Mechanisms
- System Applications of Technologies
- Summary

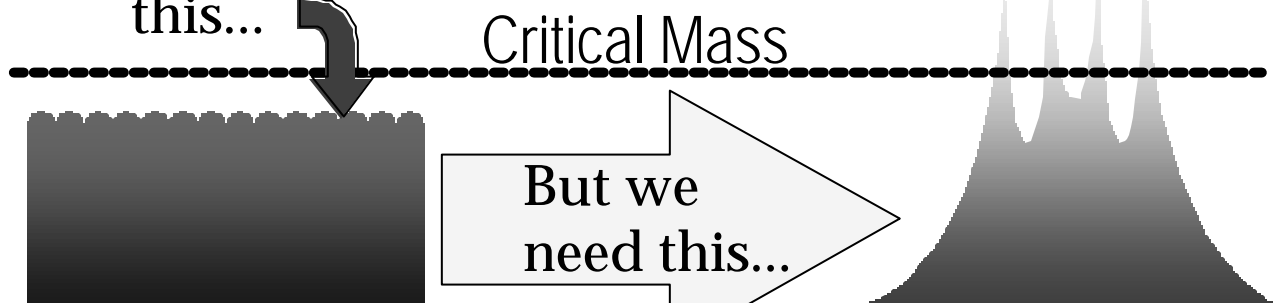
Navy's S&T Program



A Problem

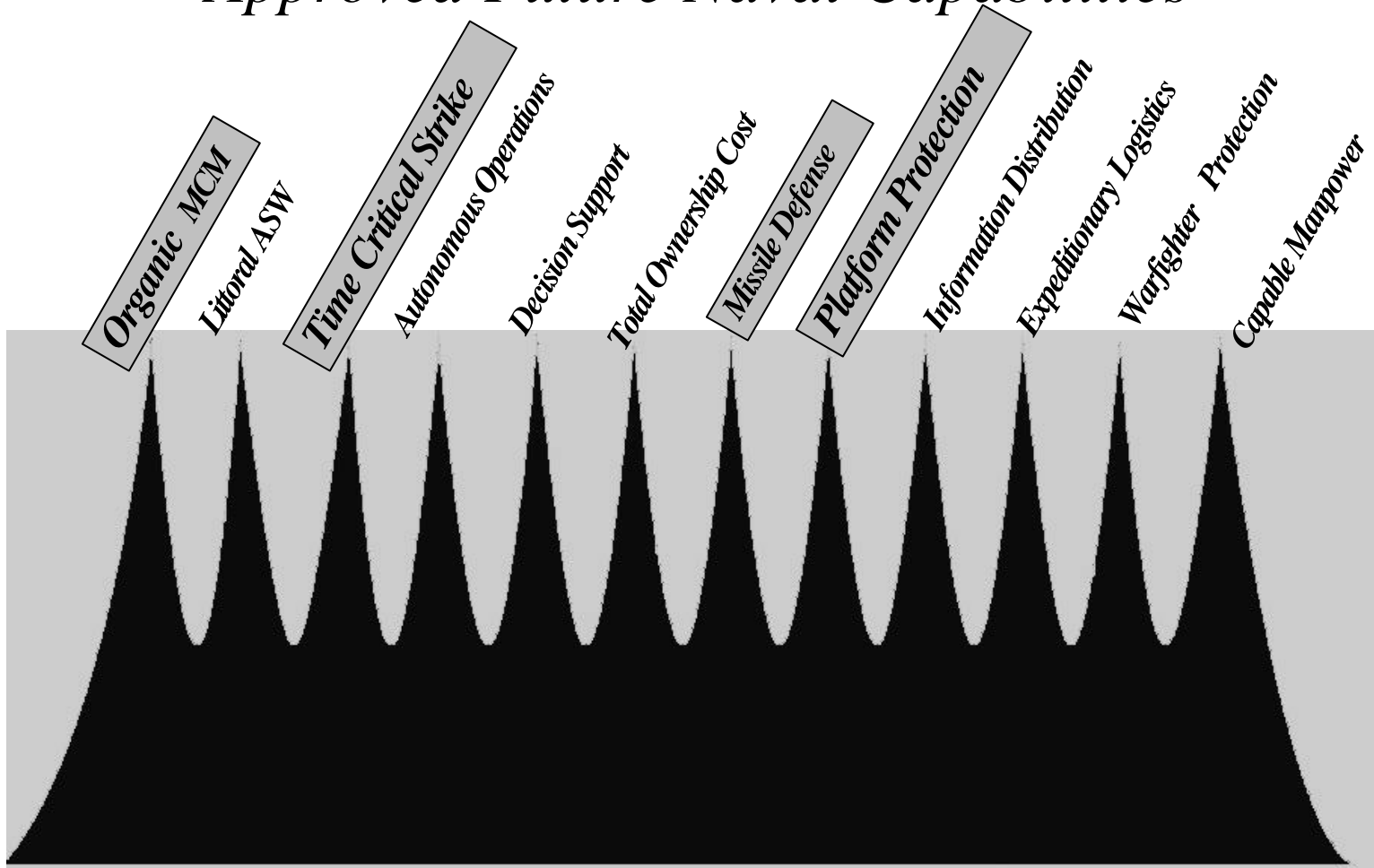


means
this...



Navy's S&T Program

Approved Future Naval Capabilities





Naval Research Challenges

- Synthesis of novel energetic materials
- Kinetic and mechanistic characterization of energetic material reactions
- Initiation mechanisms for energetic materials
- Strength and fracture properties of structural and energetic materials (code development and material science aspects)
- Determination of multi-component flow effects (application for sand and MCM problems)
- Determination of bubble jetting mechanism
- Underwater cavitation modeling
- Variable output energetic materials
- Low cost materials and processes for fuze, S&A, and guidance components



Naval Technology Challenges

- Tailorable, insensitive energetic materials with substantially greater energy
- Real time monitoring of inventory condition to improve safety/reduce life cycle cost
- M&S to reduce development/scale up time and cost
- Warhead post-launch, tailored performance
- MCM energetics/obstacle clearance far-term solutions
- Aircrew escape from high performance vehicles



Impact Technology

MEMS for Fuze/Safety & Arming

Objectives

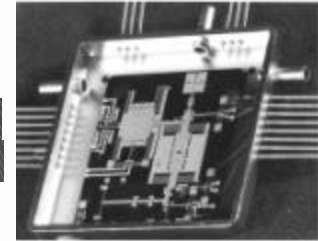
- Apply MEMS technology to miniaturize F/S&A systems for smaller undersea weapons and counterweapons
- Reduce S&A volume by an order of magnitude
- Reduce procurement and life-cycle cost

Payoffs

- Modular S&A/Exploder suitable for various weapon applications
- Development of reduced size weapons for mission flexibility
- Reduced production costs; improved safety and reliability
- Reduced logistics costs by elimination of routine maintenance requirements
- Leverage growing MEMS industrial base



**MK 48 Torpedo
MK 21 Exploder
~118 cu in**



MEMS S&A Chip



**MEMS Based Exploder
- goal of 15 cu in**

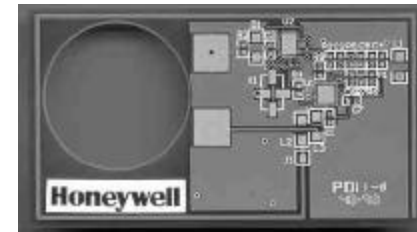


Impact Technology

MEMS for Advanced Technology Ordnance Surveillance

- **Problem**

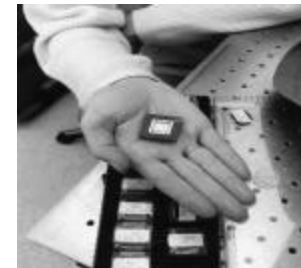
- Inaccurate Inventory Accuracy & Asset Visibility
- Need for Improved Munitions Safety & Surveillance
- Need to Improve Overall Munitions Stockpile Management



Sample RFID Tag

- **Solution**

- Integration of Radio Frequency Identification (RFID) Technology with Micro-Electromechanical System (MEMS)sensors



Sample MEMS Sensor

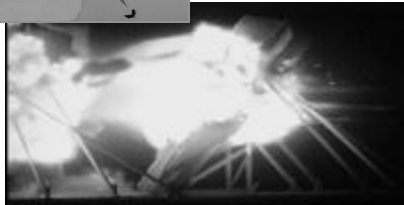
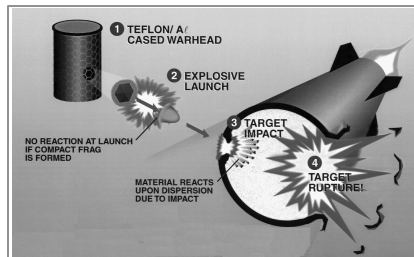
- **Bottom Line**

- Provides Real-Time Ordnance Inventory
- Improved Service Life Predictions
- Lower Total Life Cycle Cost for Munitions

Impact Technology

Emerging Materials

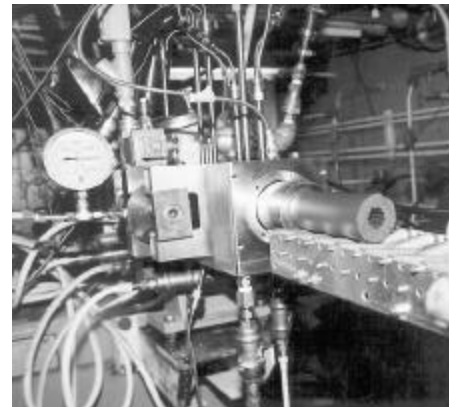
Reactive Fragments



Next Generation Gun Propellant



Variable Output Explosive

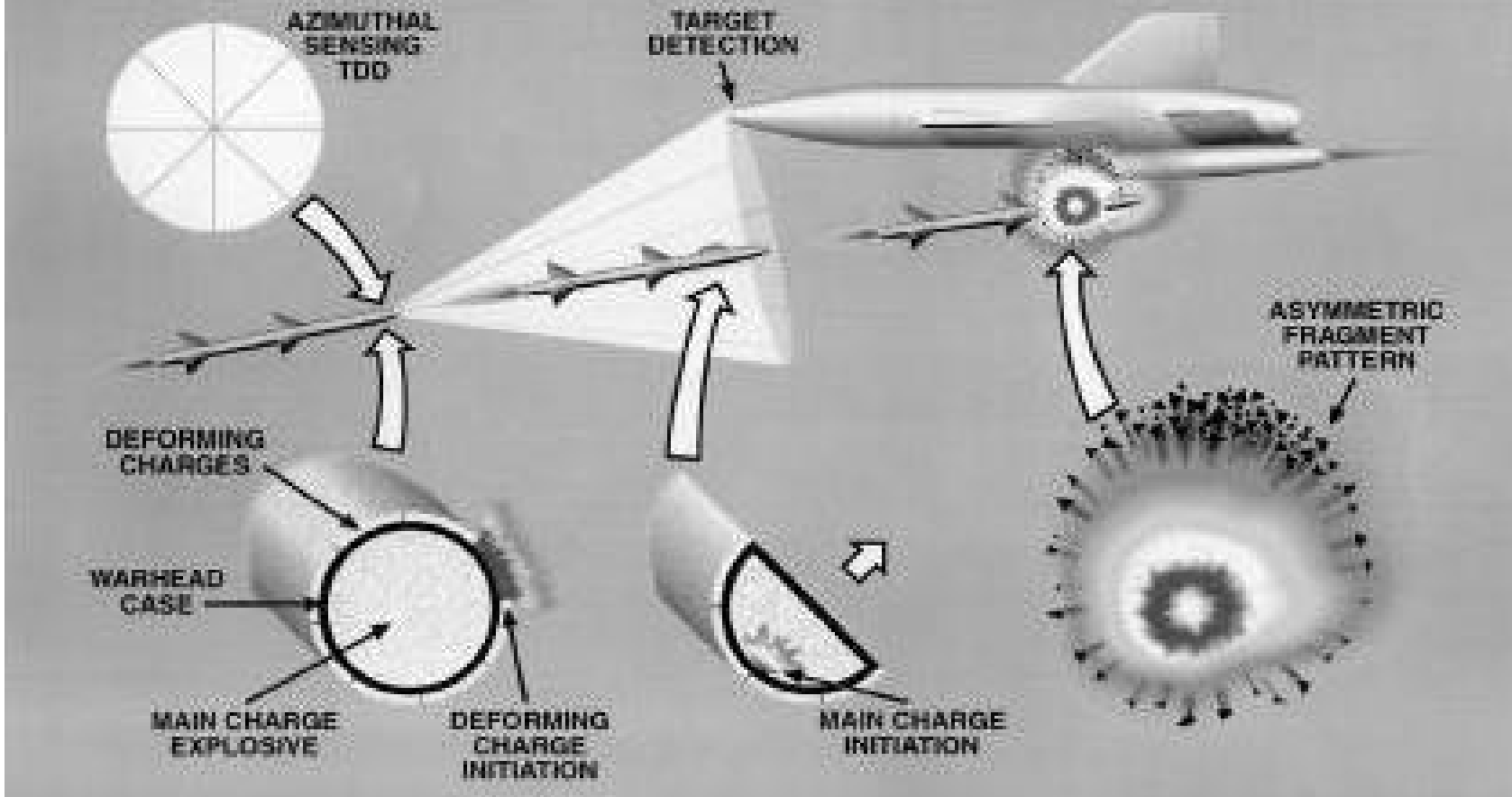


Processing S&T



Impact Technology

Initiation Mechanisms

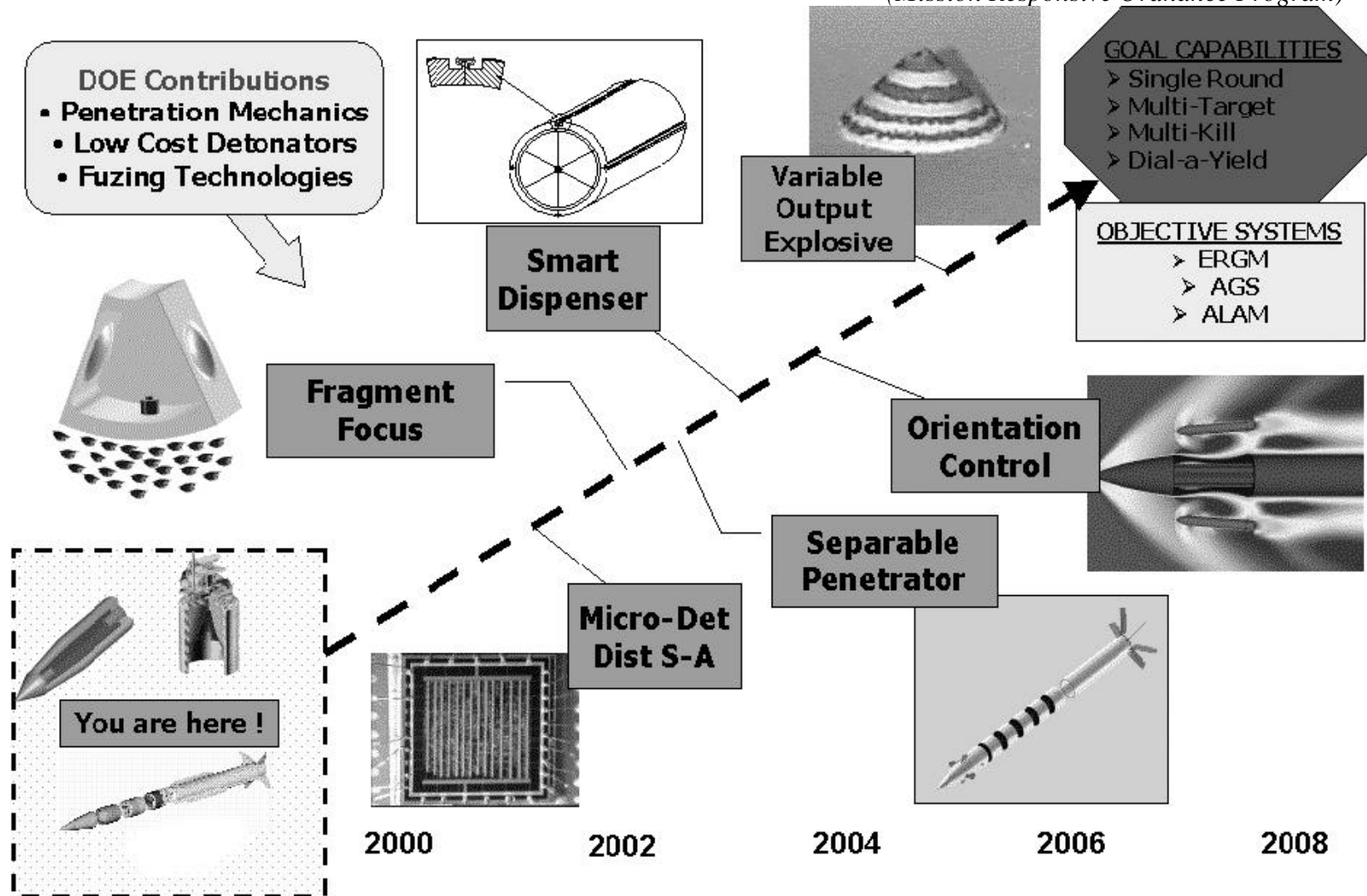


Tradeoff: need for high fragment velocity
 need for main charge to survive deforming explosion

Systems Application

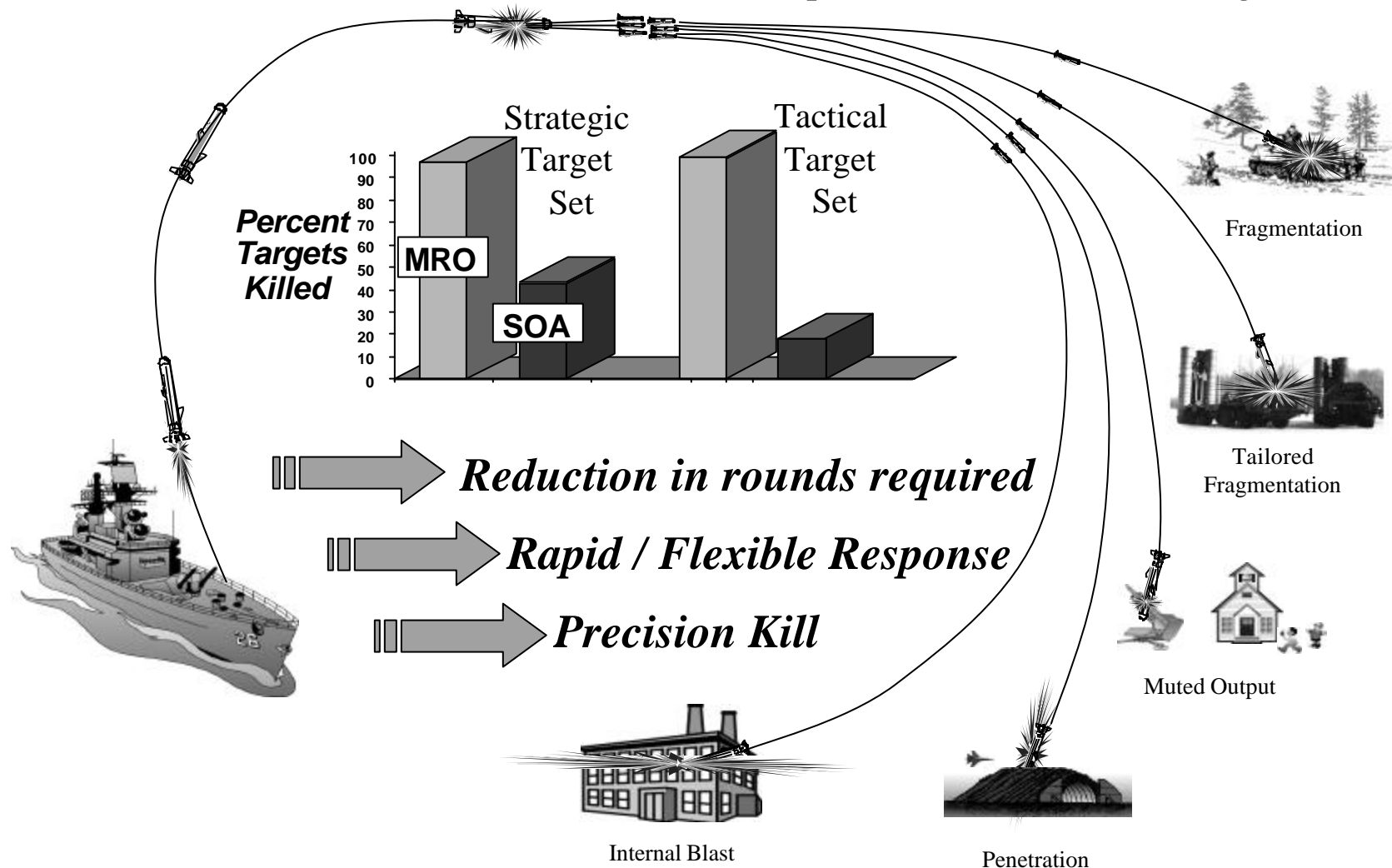
ADAPTABLE ORDNANCE TECHNOLOGY
ROADMAP

(Mission Responsive Ordnance Program)



Systems Application

Mission Responsive Ordnance Program





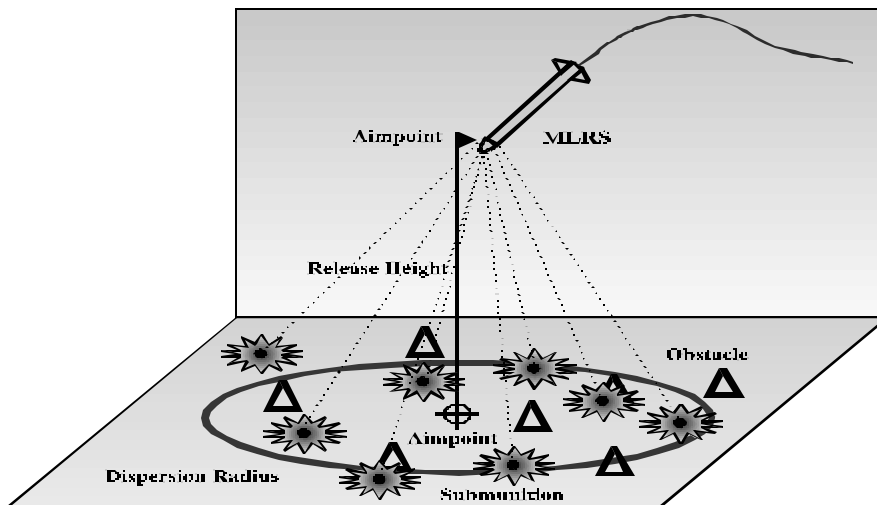
Systems Application

*Amphibious Assault Breaching MCM
FUTURE CONCEPTS*

Stand-off Capability

Delivery/Deployment

- Autonomous Surface Craft
- Autonomous Sub-surface/bottom Vehicles
- Autonomous Air Vehicles
- Air-Delivered Ordnance
- Surface Weapons (gun/missiles)

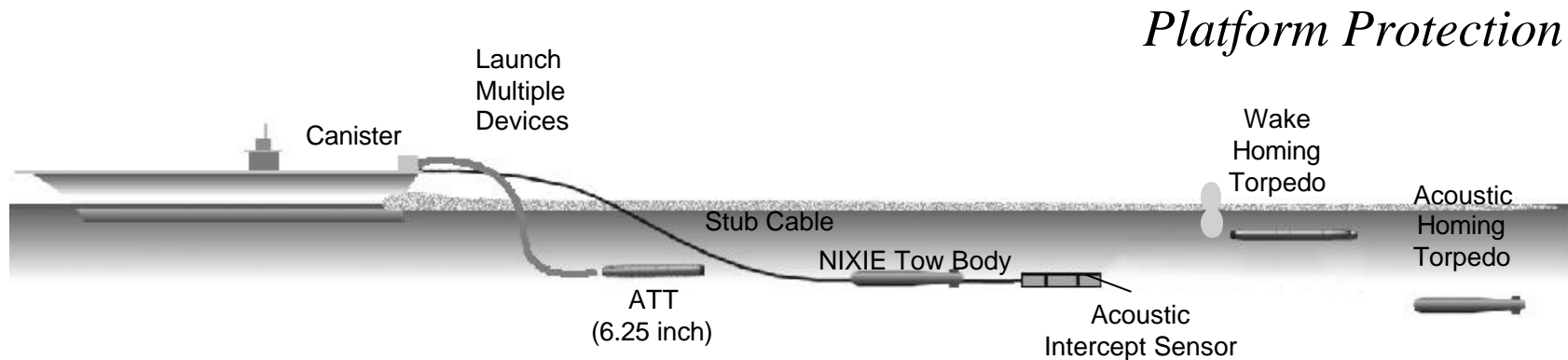


Kill Mechanism

- Bombs
- Sub-munitions
- Explosive nets
- Line Charges
- Shaped Charges
- Pulsed Power
- Mechanical Methods



Systems Application



Mission: Provide Surface Ship Torpedo Defense of Surface Combatants and Large Deck Surface Ships (Carriers, Amphibious and Logistic Ships)

Tripwire Torpedo Defense System Description

- Tripwire Detect Classify & Localize (DCL)
 - Acoustic Intercept (ACI) Sensor Towed Behind NIXIE
- **Anti-Torpedo Torpedo All-Up-Round for All Threats**
 - Combined Torpedo/Canister/Launcher System
- ATT Launched Based on Tripwire Detection



Summary

- Declining budgets - Driving more selective investments
- Complexity of warfare is increasing
- Technology opportunities and challenges are abundant